

UNIVERSITI TEKNOLOGI MARA

**DEVELOPMENT OF Z-WEIGHTED
SUM MODEL USING T-OPERATOR**

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of the requirement for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any academic institutions or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA of my study and research.

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ABSTRACT

Z-number is a concept that has been receiving more attention in recent years. The increment of Z-number usage in decision making problem recently, has given huge impact in the research world especially under fuzzy environment. In order to measure for the uncertainty, the reliability factors are considered in the information evaluation. A Z-number is an ordered pair of fuzzy numbers, $Z = (A, R)$ which consist of restriction, A and reliability, R . In Z-number, the reliability can be described as the concept of confidence level, sureness or the probability that consists a value between zero and one. Unlike fuzzy number, Z-number has more ability to explain the uncertain information and measure the reliability of the information more accurately. However, the calculation of the reliability in Z-number is still not consistent. The existing method introduced by the researcher, may not portray the reliability's value specifically, where it leads to loss of information through the calculation process. Thus, a new proposed method is introduced to cater this problem. The aims of this study are to develop an arithmetic operation, which involves with addition and multiplication operation based on the t-operator that are able to solve for the reliability in Z-number. These operations are suitable to be used due to the t-operator has the same behaviour with the probability concept where it used the value between zero and one. In this dissertation, there are three proposed arithmetic operations based on Tofan (2013) that use different types of t-operator, which are Einstein and Hamacher and combination of both. The proving of the proposed arithmetic operations are shown to prove that these operations are valid to be used. Then, the concept of Z-number is implemented in one of the Multi Criteria Decision Making methods (MCDM), which is a Weighted Sum Model (WSM) which later known as Z-WSM. The proposed arithmetic operations are used to aggregate the weighted of criteria and the rating of alternatives in the calculation of reliability in Z-WSM. Later, a comparative analysis is conducted to compare for the value of relative closeness and their ranking between the proposed methods and Tofan based on numerical example from paper Chen (2000). An analysis of each proposed arithmetic operation of Z-WSM methods has been presented. The results show that each of the methods share the same ranking value where candidates 2, E_2 was chosen as the best candidates. Finally, the Z-WSM is applied in the case study of store location selection and the result shows that among the four different locations, Kota Damansara is chosen as the preferred location for opening new stores. These proposed arithmetic operations can be used as an alternative way in solving Z-number where the reliability information can be preserved and the value of probability in the reliability can be presented through the calculation process.

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